ROAD DAMAGE PREDICTION FOR INTELLIGENT TRANSPORTATION SYSTEM

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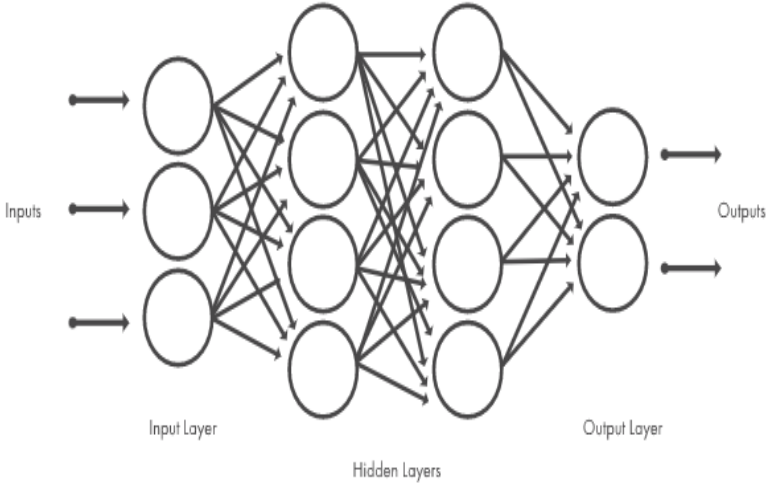
ROAD DAMAGE PREDICTION FOR INTELLIGENT TRANSPORTATION SYSTEM

A human-based road damage monitoring system could be the first answer but not a perfect solution because it is affected by a different condition such as weather, speed of the vehicle, the complexity of the road, and the difference of criteria from the individual inspection. Thus, researchers have developed much more robust and accurate automatic road surface detectors through various methods. For example, using a probabilistic relaxation technique based on 3D information , combining 2D gray-scale image and 3D laser scanning data or implementing a deep learning-based model . In this challenge, the dataset is gathered by a Smartphone based method and we evaluated with various scenarios using YOLO based on a deep learning-based algorithm. It is light-weight and fast in the object detection task, so it is available to improve the Smartphone-based model for detecting road damage. Deep learning-based technology is a good key to unlock the object detection tasks in our real world. By using deep neural networks, we could break a problem that is dangerous and very time-consuming but has to be done every day like detecting the road state. This paper describes the solution using YOLO to detect the various types of road damage in the IEEE Big Data Cup Challenge 2020. Our YOLOv5x based-solution is light-weight and fast, even it has good accuracy. We achieved an F1 score of 0.58 using our ensemble model with TTA, and it could be an adequate candidate for detecting real road damage in real-time.

ROAD DAMAGE PREDICTION FOR INTELLIGENT TRANSPORTATION SYSTEM

DEEP LEARNING

- Deep learning is a machine learning technique that teaches computers to do what comes naturally to humans.
- Deep learning models are trained by using large sets of labeled data and neural network architectures that learn features directly from the data without the need for manual feature extraction.
- Nowadays, deep learning has an important role in image classification. It extracts the feature maps from an input image using a neural network with hidden layers, and several deep learning networks based on Convolutional Neural Networks (CNNs), such as AlexNet , VGGNet , ResNet , etc, achieved a successful performance in the ImageNet Large Scale Visual Recognition Challenge (ILSVRC).



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DEEP LEARNING

- A main point is that object detection could be a combination of classification and localization, thus many approaches have developed to solve object detection tasks using deep learning-based technology. The detection model is trained with the image dataset which contains the bounding-boxes and the labels to detect an object. From the perspective of region proposal-based methods, they propose a region that may include the object, classify the object, refine and get rid of overlapped bounding boxes, and score them based on other objects in the input image. And there are representative region-based models such as R-CNN , Fast R-CNN , and Faster R-CNN , and they also called by two-stage object detectors.

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YOLO ALGORITHM

- YOLO(You Only Look Once) has a single neural network architecture, predicts a set of bounding boxes and class probabilities at a sitting for every test image.
- First of all, it divides the full image by several a grid with a specific size, and anchor boxes are generated in every grid of input image by predefined scale and size. Each anchor box predicts the objectness score, box center offset x, box center offset y, box width, box height, and class scores at one time in contrast to a two stage detector.
- Thus, YOLO is an extremely fast end-to-end algorithm to detect the objects, and it is called a one stage object detector. Also, the performance of YOLO has improved over the development of deep learning technology, so there are updated versions for improving the light-weight, inference speed, and accuracy.

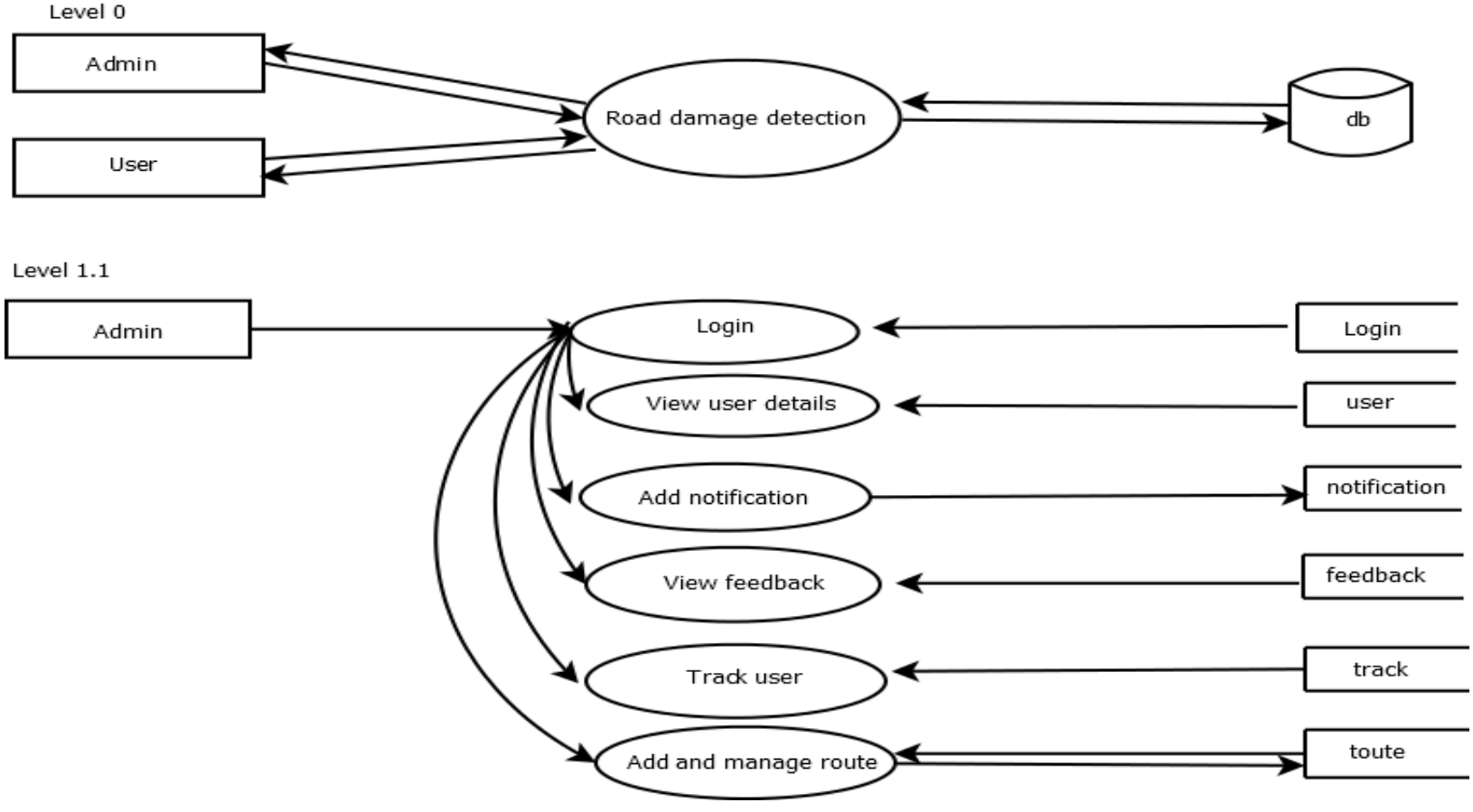
S X S grid on input

final detections

MODULES

1. Admin
   - Login
   - View users details
   - Add notification
   - View feedback
   - Track user
   - Add and manage routs
2. User
   - Register
   - Login
   - View profile
   - Road quality alert
   - feedback
   - View rout

DATA FLOW DIAGRAM



DATA FLOW DIAGRAM

Level 1.2

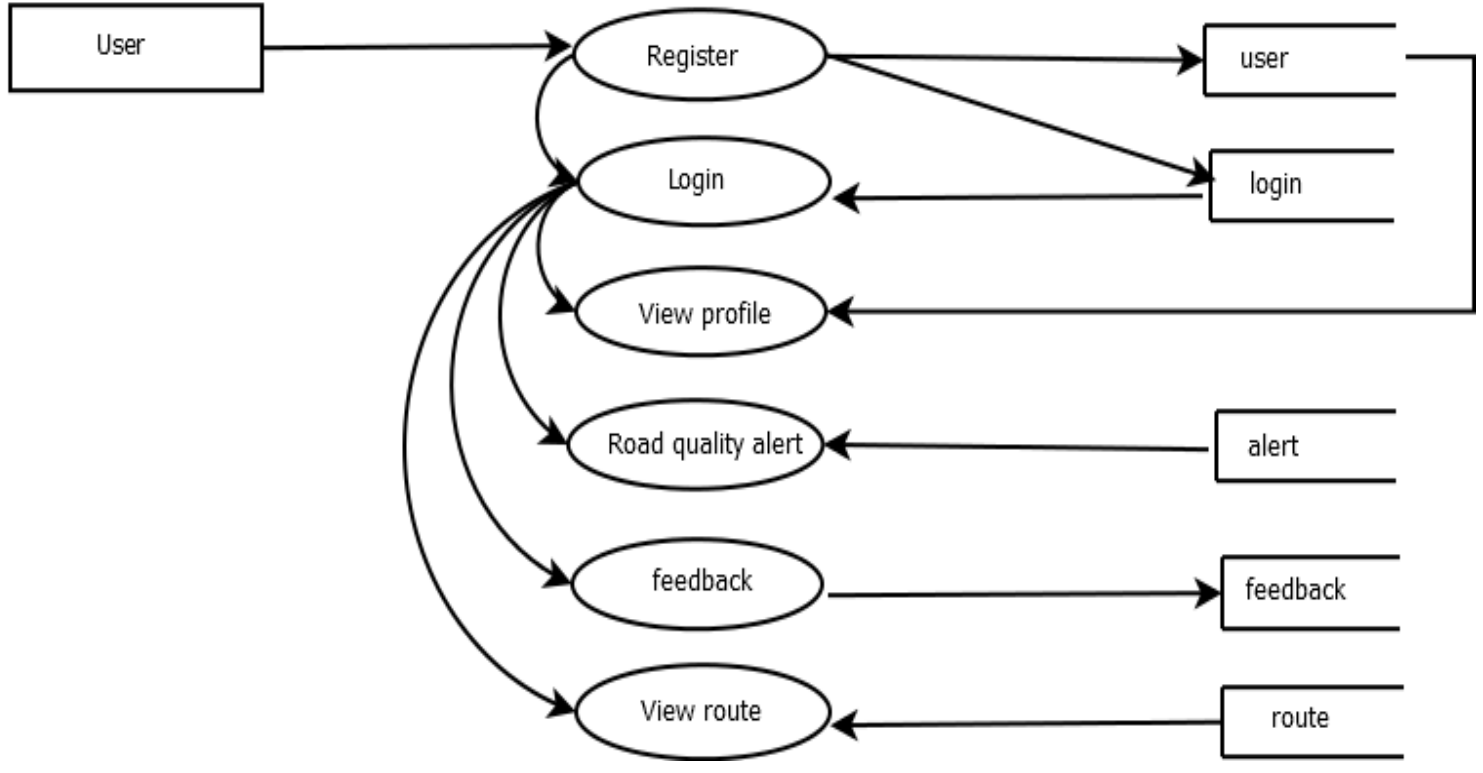


TABLE DESIGN

LOGIN

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	id	int	11		☑	☑	☐	☑	☐			
	username	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	password	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	usertype	varchar	54		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
					☐	☐	☐	☐	☐			

USER

	Field Name	Datatype	Len	Default	PK?	Not Null?	Unsigned?	Auto Incr?	Zerofill?	Charset	Collation	Comment
*	uid	int	11		☑	☑	☐	☑	☐			
	user_lid	int	11		☐	☐	☐	☐	☐			
	fname	varchar	55		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	lname	varchar	33		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	place	varchar	44		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	phone	varchar	45		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
	email	varchar	45		☐	☐	☐	☐	☐	latin1	latin1_swedish_ci	
					☐	☐	☐	☐	☐			

DEVELOPING ENVIRONMENT

- OPERATING SYSTEM : WINDOWS 10
- FRONT END : HTML, CSS, JAVASCRIPT
- BACK END : Mysql
- SOFTWARES USED : Jetbrains Pycharm , Android Studio
- TECHNOLOGY USED : PYTHON,JAVA
- FRAME WORK USED : Flask

PRODUCT BACKLOG

User Story ID	Priority <High/Medium/Low>	Size (Hours)	Sprint <#>	Status <Planned/In progress/Completed>	Release Date	Release Goal
1	Medium	2	1	Completed	08/01/2022	Table design
2	High	3		Completed	08/01/2022	Form design
3	High	5		Completed	08/01/2022	Basic coding
3	High	5	2	Planned		Data collection
4	Medium	5		Planned		Data processing
5	High	5	3	Planned		Prediction
6	medium	5		Planned		Location based alert
7	Medium	5	4	Planned		Testing data
8	High	5		Planned		Output generation

USER STORY

User Story ID	As a type of User	I want to <perform some task>	So that I can < Achieve Some Goal>
1	Admin	Login	login successful with correct username and password
2	Admin	View User details	Can view registered users
3	Admin	Add& manage notification	Insert ,view & remove notification
4	Admin	View feedback	Can view feedbacks from user
5	Admin	Track user	Track users who are travelling
6	Admin	Add and manage rout	Can add and manage rout
7	User	Register	Can users register
8	User	Login	Registered users can login with correct username and password
9	User	View profile	View users profile in application
10	User	Road quality alert	Can get alert while travelling
11	User	Feedback	Can provide feedback
12	User	View rout	Can view rout in application

PROJECT PLAN

User Story ID	Task Name	Start Date	End Date	Days	Status
1	Sprint 1	26/12/2021	28/12/2021	10	completed
2		29/12/2021	31/12/2021		completed
3		03/01/2022	08/01/2022		completed
3	Sprint 2	09/01/2022	16/01/2022	13	In progress
4		18/01/2022	22/01/2022		In progress
5	Sprint 3	23/01/2022	27/01/2022	12	In progress
6		30/01/2022	05/02/2022		In progress
7	Sprint 4	06/02/2022	10/02/2022	9	In progress
8		16/02/2022	19/02/2022		In progress

SPRINT BACKLOG

Backlog Item	Status And Completion Date	Original Estimation in Hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
UserStory#1,#2,#3			hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Table Designing	28/12/2021	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Form Designing	31/12/2021	3	0	0	1	1	1	0	0	0	0	0	0	0	0	0
Coding	8/01/2022	5	0	0	0	0	0	1	1	1	1	1	0	0	0	0
UserStory#4, #5																
Data collection	16/01/2022	5	1	1	0	1	1	1	0	0	0	0	0	0	0	0
Data processing	22/01/2022	5	0	0	0	0	0	0	0	1	1	0	1	1	1	0
UserStory#6,#7																
Prediction	27/01/2022	5	1	1	1	0	1	1	0	0	0	0	0	0	0	0
Location based alert	5/02/2022	5	0	0	0	0	0	0	0	1	1	1	1	1	0	0
UserStory#8,#9																
Testing Data	10/02/2022	5	1	1	1	1	1	0	0	0	0	0	0	0	0	0
OutputGenaration	20/02/2022	5	0	0	0	0	0	0	2	2	1	0	0	0	0	0
Total		40	4	4	3	3	4	3	3	5	4	2	2	2	1	0

ACTUAL SPRINT

Backlog Item	Status And Completion Date	Original Estimation in Hours	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14
UserStory#1, #2,#3			hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs	hrs
Table Designing	28/12/2021	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Form Designing	31/12/2021	4	0	0	0	1	1	0	1	1	0	0	0	0	0	0
Coding	8/01/2022	4	0	0	0	0	0	0	0	0	2	1	1	0	0	0
UserStory#4, #5																
Data collection																
Data processing																
UserStory#6, #7																
prediction																
Location based alert																
UserStory#8, #9																
Testing Data																
Output Generation																
Total		10	1	1	0	1	1	0	1	1	2	1	1	0	0	0

Thank
you